

ABSTRACT

Modular, stackable, flow-through plate or channel reactor units for continuous, low temperature, catalytic reactions of two separate process reaction streams; typically the first is an exothermic combustion process and the second, an endothermic reforming process. Each reactor unit comprises two separate sets of flow channels or slot-type reaction zones formed in flow plates located between spaced, thin metal, highly heat-conductive metal foil or platelet separator walls, adjacent reactors in a stack including a common, medially located, bi-catalytic separator plate, i.e., a separator plate having on opposed surfaces the same or different catalysts selected for the particular reaction taking place in the adjacent reactor zone. Each flow plate has a relieved medial area defining the reaction zone, the side walls of which are the catalyst coated separator platelets. A separator platelet thus separates two adjacent reaction zones, one on each side and functions to transfer heat from the combustion occurring at the catalyst surface in the combustion zone directly to the reforming catalyst coated on the opposed surface. The reaction zones may include structures such as grooved plates or packed spheres to direct the feedstock gases to the catalyst coated on the platelet surfaces. Support frames, gaskets, manifolding, insulating spacers, end plates and assembly hardware and methods are also disclosed. Multiple modular reactor units or cells may be stacked to provide a reactor of any desired throughput capacity and portability. The invention also comprises methods for the catalytic reforming of hydrocarbon fuels for the production of synthesis gas or hydrogen employing the bi-catalytic reactor of the invention.